Taylor Larrechea
Dr. Middleton PHYS 132 HW
2-9-17 Ch. 28

Ch. 28 CQ'S: 9
Probs: 26, 30, 38

Conceptual

28.C.9

a.) $V = ES$

The ratio of V_2/V_1

$V_1 = E(1mm)$ $V_2 = E(3mm)$

$V_1 = 0.001EM$ $V_2 = 0.003EM$

$\frac{V_2}{V_1} = \frac{0.003EM}{0.001EM} = \boxed{\frac{3V_2}{V_1}\ J/C}$

b.) $E = \frac{\Delta V}{d}$ Since electric field is dependent on seperation distance of the plates, the electric field is the same at both points since the seperation distance of the plates do not change.

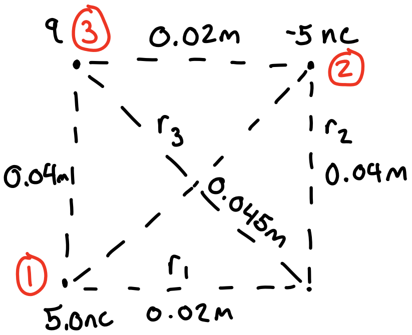
Problem

28.P.26

$V = ES$ $V = 3140\,V$

$V = \frac{U}{q}$

$V = \frac{KQ}{r}$ $V = 3140\,V$



$V = V_1 + V_2 + V_3$

$V_1 = \frac{KQ_1}{r_1}$ $V_2 = \frac{KQ_2}{r_2}$ $V_3 = \frac{KQ_3}{r_3}$

$V_1 = \frac{9.0\times10^9 \frac{Nm^2}{C^2}(5.0\times10^{-9}C)}{0.02m}$ $V_2 = \frac{9.0\times10^9 \frac{Nm^2}{C^2}(-5.0\times10^{-9}C)}{0.04m}$ $V_3 = \frac{9.0\times10^9 \frac{Nm^2}{C^2}(Q_3)}{0.045m}$

$r_1 = 0.02m$ $Q_1 = 5\times10^{-9}c$

$r_2 = 0.04m$ $Q_2 = -5\times10^{-9}c$

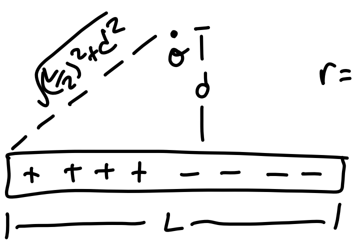
$r_3 = 0.045m$ $Q_3 =$

$V_1 = 2250V$ $V_2 = -1125V$ $V_3 = \frac{9.0\times10^9 \frac{Nm^2}{C^2}(Q_3)}{0.045m}$

$3140\,V = 2250\,V - 1125\,V + 2\times10^{11}\frac{NM}{C^2}(Q_3)$

$\boxed{Q_3 = 1.0\times10^{-8}c}$ $Q_3 = \frac{3140V - 2250V + 1125V}{2.0\times10^{11}\frac{NM}{C^2}}$

28.P.30



$z = L/2$

$r = \sqrt{(\frac{L}{2})^2 + d^2}$

$\sin\theta = \frac{L/2}{\sqrt{(L/2)^2 + d^2}} = \frac{L}{2\sqrt{(\frac{L}{2})^2 + d^2}}$

$dE_y = dE\sin\theta$

$= \frac{KdQ}{r^2}\sin\theta$

$dE_y = \frac{K\lambda dx}{(x)^2 + d^2}\left(\frac{x}{\sqrt{(x)^2 + d^2}}\right)$

$u = x^2 + d^2$

$du = 2x\,dx$ $u^{-3/2}$

$\frac{1}{2}du = x\,dx$ $-2u^{-1/2}$

$K\lambda \int_0^{L/2} \frac{x\,dx}{((x)^2 + d^2)^{3/2}}$

$\frac{K\lambda}{2}\int_0^{L/2} \frac{1}{(u)^{3/2}}du$

$\frac{K\lambda}{2}\left[\frac{-2}{\sqrt{x^2 + d^2}}\right]_0^{L/2}$ $\frac{-K\lambda}{\sqrt{x^2 + d^2}} = \frac{-K\lambda}{\sqrt{(\frac{L}{2})^2 + d^2}} + \frac{K\lambda}{d}$ $K\lambda\left(\frac{-1}{\sqrt{(\frac{L}{2})^2 + d^2}} + \frac{1}{d}\right)$

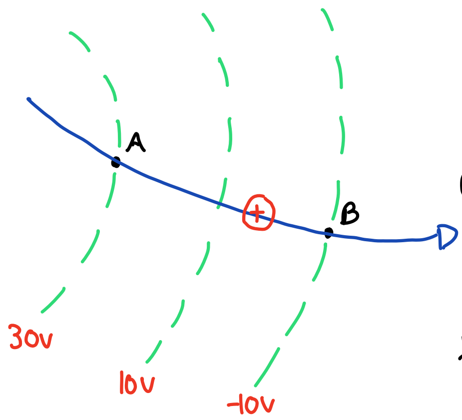
Due to symmetry on the point, the x-components will cancel out both directions for x. Therefore the y-component of the right side is the same as the left

Left Side: $K\lambda\left(\frac{1}{d} - \frac{1}{\sqrt{(\frac{L}{2})^2+d^2}}\right)$

$\boxed{2K\lambda\left(\frac{1}{d} - \frac{1}{\sqrt{(\frac{L}{2})^2+d^2}}\right)}$

$\boxed{28.P.38}$

A = 50,000 m/s



$V_0 = 50{,}000$ m/s

$U_A = 4.8\times10^{-18}$ J
$U_B = -1.6\times10^{-18}$ J

$U = qV$ $\quad q = 1.602\times10^{-19}$ C

(A) $U = 1.60\times10^{-19}\,C(30\,J/C)$
$U = 4.8\times10^{-18}$ J

(B) $U = 1.60\times10^{-19}\,C(-10\,J/C)$
$U = -1.6\times10^{-18}$ J

$K_0 + U_0 = K_1 + U_1$
$\frac{1}{2}mv_0^2 + U_a = \frac{1}{2}mv_1^2 + U_B$
$\frac{1}{2}mv_0^2 + U_a - U_B = \frac{1}{2}mv_1^2$
$mv_0^2 + 2U_a - 2U_B = mv_1^2$
$V_1 = \sqrt{\frac{mv_0^2 + 2U_a - 2U_B}{m}}$

$V_0 = 50{,}000$ m/s
$m = 1.67\times10^{-27}$ Kg
$U_a = 4.8\times10^{-18}$ J
$U_B = -1.6\times10^{-18}$ J

$\boxed{V_1 = 1.01\times10^{5}\ m/s}$